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Case Report

Treatment of Anterior Crossbite with Skeletal Class III Malocclusion during the Growth Period

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Abstract

Anterior crossbite is the most common problem in Angle class III malocclusion and is aesthetically disturbing. As individuals get older, an anterior crossbite can worsen, impacting the esthetics of the face and the stomatognathic system's function significantly and requiring immediate treatment. Due to genetics, habitual postures, ethnicity, and environmental variables, the class III malocclusion's etiology is multifaceted. In terms of treatment, there are three options: growth modification, camouflage, and orthognathic surgical treatment. This case report aims to describe a non-surgical treatment with simple treatment mechanics in two patients who were still in their growth period. Two patients, a sibling aged 14 and 13 years, experienced an anterior crossbite with a deep overbite, diagnosed with Angle class III with skeletal class III relationships. Besides, the profile revealed a concave, with an overjet of -2mm and an overbite of 4mm. The treatments were then performed employing fixed orthodontic appliances with vertical U-loops for protraction of upper anterior teeth and class III intermaxillary elastics to correct molar relationships. The treatment was completed in two years, in which the anterior crossbite was corrected. The molar and canine relationships, which were originally class III, became class I. Loss of tooth 36 was closed, and tooth 38 has fully erupted. Treatment of anterior crossbite needed to be done as soon as possible to prevent more severe abnormalities. In conclusion, a treatment in the growth period with simple techniques resulted in significant improvements in function and aesthetics.

Keywords: anterior crossbite; class III; fixed orthodontics

INTRODUCTION

Skeletal Class III relationships can result from a normal maxillary with more anterior mandibular growth (prognathic) or maxillary retrognathic with a normal mandible or an integration of both (maxillary retrognathic and mandibular prognathic).[1] For the skeletal Class III malocclusion correction, Proffit states three treatment options: 1) growth modification, using differential growth of the maxilla relative to the mandible; 2) camouflage of the skeletal discrepancies through tooth movements to correct dental occlusion while maintaining skeletal discrepancy; 3) orthognathic surgical correction.[2]

More specifically, the common anterior crossbite in skeletal class III relationships may get worse along with increased age, affecting the esthetics of the face and the stomatognathic system's function significantly.[1] Anterior crossbite is a malocclusion involving at least one maxillary incisor, which is more palatally occludes than the mandibular incisors. Crossbite can be caused by dental and bone factors.[3]

Furthermore, due to the influence of genetics, habitual postures, ethnicity, and environmental variables, the class III malocclusion's etiology is multifaceted[1], and Asian populations have been examined

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to have a greater prevalence of the disease.[4] In addition, investigations on human genetics have produced sufficient data to indicate that heredity is the primary determinant of mandibular development. In this regard, the genetic inheritance of a family provides a substantial impact on the dimensions of skeletal craniofacial, which contributes to Class III malocclusions. In members of several generations, a significantly greater prevalence of these malocclusions has been discovered.[5]

In most class III cases, malocclusion involving four or more teeth in the anterior crossbite occurs. Compared to the upper lip, the lower lip is frequently more prominent and should be corrected as early as possible.[6] Anterior crossbite is also associated with various complications, for instance, wear of the incisal edges, the gingival recession in the lower incisors, and ultimately tooth loss. Correction of the anterior crossbite can thus improve oral health and achieve better occlusion[7]. Therefore, it is crucial to do the anterior crossbite correction immediately. For this reason, this article describes the Angle class III malocclusion treatment with skeletal class III relationships due to genetic factors, accompanied by anterior crossbite and deep bite, in sibling patients who were still in their growth period.

CASE REPORT

Siblings, a 14-year-old girl and a 13-year-old boy, had the same malocclusion, namely Angle class III malocclusion with anterior crossbite (Dewey type 3). Skeletal Class III relationships were with mandibular prognathic. One of the parents and grandfather of the two patients had the same abnormalities, so the skeletal class III relationships were due to genetic factors. Furthermore, the treatment in these two cases aimed to do the anterior crossbite correction, achieve a normal overjet and overbite with proclination of the upper anterior teeth and retraction of the lower anterior teeth, improve the facial profile and lip posture, as well as closing the mandibular dental space, thereby preventing the development of more severe skeletal abnormalities.

Case 1: A 14-year-old female patient complained of more advanced lower front teeth. The examination of the extra-oral lateral profile of the face was slightly concave and symmetrical, with the mandibular prognathic and the lower lip positioned more forward than the upper lip. Intraoral examination showed a class III molar relationship with class I canine, anterior crossbite with negative overjet (-3 mm) that greatly affected facial esthetics, 3 mm overbite, and tooth 36 had been extracted due to caries. The patient's permanent teeth, comprising the third molars, were all visible on the first panoramic radiograph, and in general, the alveolar bone and tooth roots were also normal (Figure 1). In addition, the examination of cephalometric depicted skeletal class III relationships (ANB:-4.5°), with a relatively normal maxilla (SNA: 83.5°) but a prognathic mandible (SNB: 88°) (Table 1).

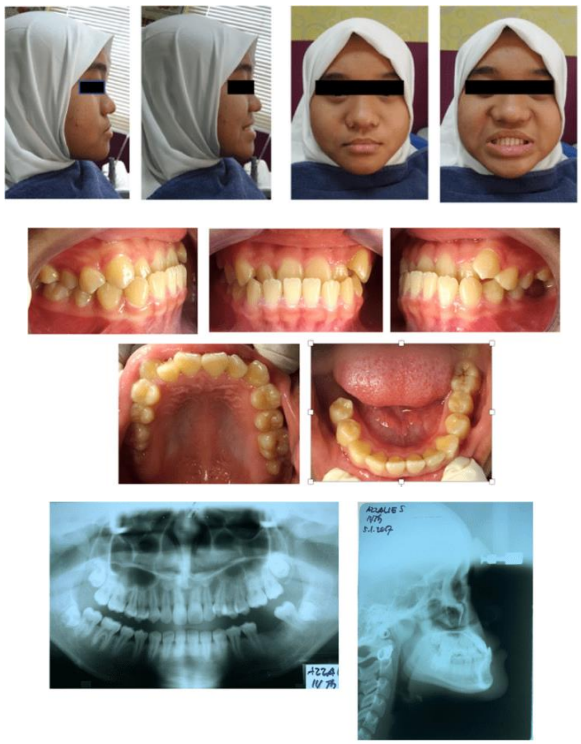

Figure 1. Extra-oral, intra-oral, and pre-treatment radiographs (case 1)

Case 2: A 12-year-old male patient complained of more advanced lower front teeth. The examination of the extra-oral lateral profile of the face was slightly concave and symmetrical, with the prognathic mandible and the lower lip positioned more forward than the upper lip. Intraoral examination revealed a relationship between class III molar and class I canines, anterior crossbite with negative overjet (-3 mm) that greatly affected facial esthetics, 3 mm overbite, and a diastema on the lower anterior teeth. The patient's permanent teeth, comprising the third molars, were all visible on the first panoramic radiograph, and in general, the alveolar bone and tooth roots were also normal (Figure 2). Furthermore, the examination of cephalometric showed skeletal class III relationships (ANB: -9.3°), with a relatively normal maxilla (SNA: 80.2°) but a prognathic mandible (SNB: 89.5°) (Table 2).

Figure 2. Extra-oral, intra-oral, and pre-treatment radiographs (case 2)

Case Management:

Both patients were still in their growth period, so no invasive treatments such as extraction or orthognathic surgery were performed. Considering the negative overjet and the patients' age, treatment in class III skeletal pattern correction exploited the remaining growth potential by moving the teeth to achieve labial inclination of the maxillary incisors as well as retraction of the mandibular incisors.

The treatments were then performed using a fixed orthodontic appliance with a straight wire system slot 0.22. A resin bite block was added to the lower posterior teeth early to separate the bite and facilitate correction of the anterior crossbite. At the initial stage, leveling and alignment of the teeth were carried out from 0.12 to 0.18 wire. Next, they were replaced with 0.16 diameter ss wire with a vertical U-loop at the mesial teeth 13 and 23 for both intrusion and protraction of the upper anterior teeth (Figure 3). At the beginning of treatment, both patients used class III intermaxillary elastics ¼ 4 oz until the crossbite was corrected.

It took about eight months to achieve the anterior crossbite leveling, alignment, and correction. Furthermore, several brackets were repositioned and continued to close the space in the lower jaw. In case 1, the extraction space for tooth 36 was closed using elastic from teeth 23 to 37 to mesialize tooth 37 to facilitate the eruption of tooth 38. In case 2, the diastema of the lower anterior teeth was closed utilizing a power chain from teeth 44 to 34. After approximately two years, the treatment goals have been achieved and continued using upper and lower removable retainers used for retention.

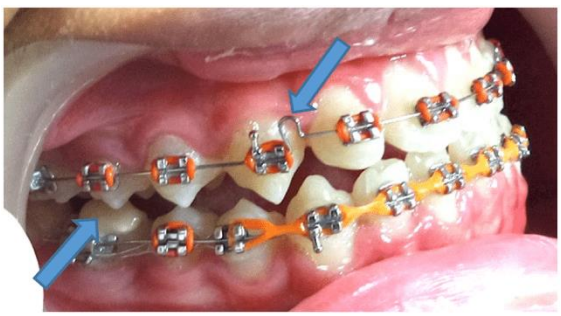

Figure 3. Vertical U-loop and resin bite block on the lower first molar

Treatment Outcome for Case 1:

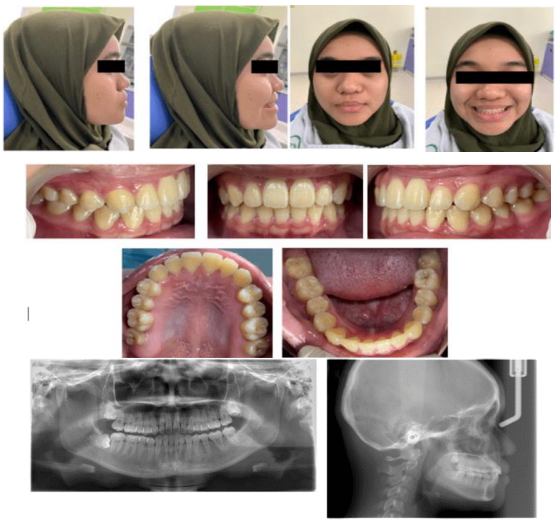

Figure 4. Extra-oral, intra-oral, and radiographs after treatment (case 1)

Table 1. Cephalometric analysis results before and after treatment (case 1)

Measurement	Mean	Before	After
SNA	81.08	83.48	85.82
SNB	79.17	88.01	88.43
ANB	2.46	-4.53	-2.60
Occlusal Plane to SN Angle	14	6.66	5.30
Mandibular Plane Angle (Go-Gn to SN)	32	21.07	19.95
U1 to NA (mm)	4	6.29	9.67
U1 to NA (deg)	22	28.29	33.29
L1 to NB (mm)	4	3.65	3.06
L1 to NB (deg)	25	16.41	20.79
Interincisal Angle	128	139.82	128.53

Treatment Outcome for Case 2:

Figure 5. Extra-oral, intra-oral, and radiographs after treatment (case 2)

Table 2. Cephalometric analysis results before and after treatment (case 2).

Measurement	Mean	Before	After
SNA	81.77	80.21	82.61
SNB	80.42	89.59	87.37
ANB	2.05	-9.38	-4.76
Occlusal Plane to SN Angle	14	11.63	4.21
Mandibular Plane Angle (Go-Gn to SN)	32	21.48	23.62
U1 to NA (mm)	4	14.67	12.01
U1 to NA (deg)	22	39.19	43.80
L1 to NB (mm)	4	3.79	1.63
L1 to NB (deg)	25	15.75	18.60
Interincisal Angle	128	134.44	122.36

Both cases were successfully resolved by achieving a class I molar and canine relationship, corrected anterior crossbite, normal overjet and overbite, and relative median line in one line. The facial profile was maintained with little change, i.e., it was still slightly concave (Figures 4 and 5). The cephalometric analysis results still showed a skeletal class III relationship, but there was a change in ANB of more than 2°. In addition, the maxillary incisors were still proclined, with an increase in the I-NA angle (Tables 1 and 2), but aesthetically, it was still quite good. In case 1, the remaining space of tooth 36 extraction was successfully closed with the eruption of tooth 38 so that the patient was free from dentures. In case 2, the lower anterior teeth' diastema was also closed with the lower anterior teeth' retraction.

DISCUSSION

Both cases of the siblings had a class III skeletal pattern with mandibular prognathic due to genetic factors, where the mother and grandfather of the patients had the same condition. It indicated that genetic factors strongly influenced class III malocclusion, which in this case, occurred in many family members. Genetic factors' contribution to Class III malocclusion has been the concern of many researchers. Evidence has shown that genetic factors contributed to the susceptibility to

malocclusion.[8] However, both patients were still in their growth period, so it was still possible to perform treatment without invasive procedures, such as extraction or surgery. If treatment were not immediately carried out, it would result in more severe skeletal abnormalities, and if it passed the growth stage, correction of the anterior crossbite would be more difficult and might even require combined orthodontic treatment and orthognathic surgery.

In class III malocclusion, the interceptive approach can be carried out with various devices, encompassing removable and fixed orthodontic appliances, functional removable appliances, protraction headgear, chincups, as well as systems of skeletal anchorage. Any chosen treatment will not matter as all these options are effective. The treatment's long-term stability is particularly important, which is contingent on sustainable, profitable growth.[9] Camouflage treatment can be performed with various approaches, including tooth extraction, distalization of the mandibular teeth, and Class III intermaxillary elastics.[10] In orthodontic camouflage treatment, skeletal problems disguise the dentoalveolar compensation, while the function, aesthetics and occlusion allow for an enhancement.[11] In both cases, camouflage treatment was chosen using a fixed orthodontic appliance, where tooth movement was performed to correct tooth occlusion by correcting anterior crossbite and reducing and preventing more severe skeletal abnormalities. Skeletal abnormalities in both cases were still class III, where the ANB of both patients was still below normal. However, there was a significant decrease in ANB, namely ANB -4.54° to -2.6° in case 1 and ANB -9.38° to -4.76° in case 2.

Anterior crossbite in growing individuals can be very detrimental. It disrupts environmental conditions in the oral cavity and can cause severe aesthetic disharmony and functional impairment.[12] Moreover, anterior crossbite has been reported to be associated with various complications, for instance, wear of the incisal edges, the gingival recession in the lower incisors, and worsening growth patterns. The anterior crossbite correction thus will increase the maxillary arch perimeter, provide the canines and premolars extra room to erupt, as well as obtaining a more stable orthopedic outcome.[4] In anterior crossbite correction, separation of the bite (open the bite) to obtain a non-inhibiting pathway at the beginning of tooth movement is vital. Some treatment options for an anterior crossbite include reversed stainless-steel crowns, tongue blades, bonded resin-composite slopes, fixed acrylic planes, and removable acrylic appliances with finger springs. However, this method is not comfortable and effective in young patients with mixed dentition. For adult patients, fixed appliances with class III elastics and bondable resin bites for dissolution effectively correct anterior crossbites.[7] A case report reported that lingual retraction of the mandibular incisors using class III elastics in a 14-year-old patient was very effective for anterior crossbite correction so that a positive overjet was obtained.[13]

In addition, the advantages of the fixed appliance of orthodontic treatment included improved control in three teeth dimensions as well as continuous force release.[4] In this report, the anterior crossbite corrections were performed utilizing a fixed orthodontic appliance with the straight wire slot 0.22 system. Since the beginning of the treatment, resin blocks had been applied to teeth 46 and 36, which were effective as a bite enhancer so that they did not hinder the protraction of the upper anterior teeth.

Class III malocclusions often occur due to maxillary retrognathia, mandibular prognathia or a combination of both. Ellis and McNamara stated that 65-67% of all Class III malocclusions are characterized by maxillary retrognathia. Thus, maxillary protraction is an important paradigm in the early management of Class III malocclusion.[14] In class III cases,

protraction wires (protraction utility archwires with tip backbends) have been commonly used to protract the upper incisors and achieve positive overjet. The movement of the position of the upper incisors is carried out through favorable uncontrolled tipping.[6] In both cases in this report, using wires with vertical U-loop in the mesial teeth 13 and 23 with 0.16 SS wire was effective for protraction and intrusion of the upper anterior teeth. A vertical U-loop with the mesial leg higher than the distal part provided an intrusive effect, and the labial arc was positioned more anteriorly before entering into the bracket slot, providing a protraction effect. In addition, both patients were very cooperative using class III elastics. Intermaxillary elastics have been used as part of braces treatment and are available in various sizes and strengths. Class III intermaxillary elastics can cause proclination of the upper incisors, extrusion of the upper molars, distal tipping of the lower molars, and extrusion of the lower incisors.[10,15]

As a result, the goal of treatment in both cases was achieved, with the anterior crossbite corrected. In case 1, the extraction space of tooth 36 was closed properly so that the patient was free from the use of dentures, and excellent interdigitation was obtained. In case 2, although the interdigitation was not maximal, the molar and canine relationship were class I, the anterior crossbite was corrected, and the profile was maintained. In addition, both patients had been advised to remove their wisdom teeth, but it had not been done. Thus, a further observation is needed to monitor the treatment stability and the patient's motivation to use a retainer. Both patients used a removable retainer, the Hawley retainer. Furthermore, a recent systematic review showed no difference between a Hawley retainer and a vacuum retainer in terms of cost, time, arch width, occlusal contact, and patient satisfaction.[16]

CONCLUSION

Based on the result of this study, it can be concluded that genetic factors significantly influenced the class III malocclusion occurrence and needed to be treated as early as possible. Protraction of the upper anterior teeth using a vertical U-loop, accompanied by a combination of posterior bite enhancers with class III elastics, gave satisfactory results, with the anterior crossbite correction achieved. Thus, improvements in occlusion function and better aesthetics have been obtained.

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